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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/677,309	10/03/2003	Tetsuo Suzuki	243579US0X	9488

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ALEXANDRIA, VA 22314

EXAMINER
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ARANCIBIA, MAUREEN GRAMAGLIA

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 12/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/677,309

Applicant(s)

SUZUKI ET AL.

Examiner

Maureen G. Arancibia

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 24 June 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 07/04.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. **Claims 6 and 10-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

Specifically, the term "chemical processing liquid" recited in Claim 6 renders the claim indefinite, since it could refer to the liquid used in any of the process steps recited in the claims (i.e. "film removal," "chemical removal," "immersion process"). For the purposes of the following examination on the merits, the "chemical processing liquid" has been interpreted as referring to the liquid used to perform the "immersion process for chemically processing" recited in Claim 5. However, Applicant is encouraged to use more specific terms to describe the claimed subject matter to allow clear distinctions to be made between the different steps of the method. Of course, Applicant is reminded that any amendments must be supported by the original disclosure. Claims 10-13 are rejected due to their dependence on Claim 6.

3. **Claim 13 is further rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

Specifically, quaternary alkyl ammonium hydroxides are not either alkali hydroxides or alkali carbonates. Therefore, the alkali hydroxide and/or carbonate

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cannot be selected to be a quaternary alkyl ammonium hydroxide, contrary to what is recited in the claim.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. **Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 3,923,567 to Lawrence (from Applicant's IDS) in view of U.S. Patent 6,100,167 to Falster et al.**

In regards to Claim 1, Lawrence teaches a method of reclaiming silicon wafers that includes a film removal process (Column 5, Lines 52-65), a polishing process (Column 7, Lines 32-38), and a cleaning process (Column 7, Lines 38-40), wherein the method comprises a heating / removal process for heating the silicon wafer (Column 6, Lines 6-33) and for removing the surface part of the silicon wafer (Column 6, Line 49 - Column 7, Line 31), between the film removal process and the polishing process.

Lawrence does not expressly teach that the heating of the silicon wafer is performed at 150-300°C for 20 minutes - 5 hours.

Falster et al. teaches in a method of reclaiming silicon wafers (Column 1, Lines 11-13) a heating / removal process comprising heating the silicon wafer at 100-300°C for a preferred time of several to several tens of minutes up to about 1.5 hours.

(Column 3, Line 61 - Column 4, Line 10) These ranges in temperature and time meet the limitations recited in Claim 1.

(The Examiner also observes that Falster et al. (Column 3, Lines 51-60) further teaches that the time is a result-effective variable that affects the diffusion of copper to the surface of the silicon wafer, and is selected in accordance with the heating temperature.)

It would have been obvious to one of ordinary skill in the art to replace the heating step of the heating / removal process taught by Lawrence with the heating step taught by Falster et al. The motivation for making such a modification, as taught by Falster et al. (Column 2, Line 67 - Column 3, Line 50), would have been to diffuse copper to the surface of the silicon wafer without the undesirable copper precipitates that form when the heating is performed at higher temperatures.

In regards to Claims 2 and 3, Lawrence teaches that the heating / removal process can include a mechanical removal process (Column 7, Lines 25-31) and a chemical removal process (Column 6, Line 49 - Column 7, Line 21).

**6. Claims 5-8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lawrence in view of Falster et al. as applied to claim 1 above, and further in view of U.S. Patent 5,932,022 to Linn et al.**

The teachings of Lawrence and Falster et al. were discussed above.

In regards to Claims 5 and 6, the combination of Lawrence and Falster et al. does not expressly teach that an immersion process for chemically processing the silicon wafer should be performed in addition to the heating / removal process between

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the film removal process and the polishing process, or that the processing liquid can be any of the liquids recited in Claim 6.

Linn et al. teaches an immersion process for chemically processing a bare silicon wafer should be performed prior to a heating step 115 (Figure 1), wherein the processing liquid can be a mixed solution of hydrogen peroxide, ammonia, and water (SC-1 cleaning solution; Step 101; Column 3, Lines 13-20), or a mixed solution of hydrogen peroxide, hydrochloric acid, and water (SC-2 cleaning solution; Step 109; Column 3, Lines 55-65).

It would have been obvious to one of ordinary skill in the art to modify the combination of Lawrence and Falster et al. to include an immersion process for chemically processing the wafer just before the heating / removal step, with processing liquids taught by Linn et al. The motivation for making such a modification, as taught by Linn et al. (Column 4, Lines 43-49), would have been to perform the heating step on a wafer with a relatively metal-free, hydrophilic surface, such that the finally processed wafer has an increased minority carrier diffusion length.

In regards to Claims 7, 8, 10, and 11, Lawrence teaches that the heating / removal process can include a mechanical removal process (Column 7, Lines 25-31) and a chemical removal process (Column 6, Line 49 - Column 7, Line 21).

**7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lawrence in view of Falster et al. as applied to claim 3 above, and further in view of U.S. Patent 5,837,662 to Chai et al.**

The teachings of Lawrence and Falster et al. were discussed above.

The combination of Lawrence and Falster et al. does not expressly teach that the chemical removal step can be performed using alkali hydroxides and/or alkali carbonates.

Chai et al. teaches that a chemical removal step can be performed using alkali hydroxides and/or alkali carbonates. (Column 4, Lines 4-7)

It would have been obvious to one of ordinary skill in the art to use alkali hydroxides and/or alkali carbonates in the chemical removal step taught by the combination of Lawrence and Falster et al. The motivation for making such a modification, as taught by Chai et al. (Column 4, Lines 24-34), would have been that the alkaline bath changes the surface potential of the silicon wafer, causing contaminants to be electrostatically repelled from the surface.

**8. Claims 9, 12, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lawrence in view of Falster et al., and further in view of Linn et al. as applied to claims 8 and 11 above, and further in view of Chai et al.**

The teachings of Lawrence, Falster et al., and Linn et al. were discussed above.

The combination of Lawrence, Falster et al., and Linn et al. does not expressly teach that the chemical removal step can be performed using alkali hydroxides and/or alkali carbonates, including any of the compounds recited in Claim 13.

Chai et al. teaches that a chemical removal step can be performed using alkali hydroxides and/or alkali carbonates, including sodium or potassium hydroxide or sodium or potassium carbonate. (Column 4, Lines 4-7)

It would have been obvious to one of ordinary skill in the art to use one of the alkali hydroxides and/or alkali carbonates in the chemical removal step taught by the combination of Lawrence, Falster et al., and Linn et al. The motivation for making such a modification, as taught by Chai et al. (Column 4, Lines 24-34), would have been that the alkaline bath changes the surface potential of the silicon wafer, causing contaminants to be electrostatically repelled from the surface.

### ***Conclusion***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent 6,054,373 to Tomita et al. also teaches a heating / removal step for a silicon wafer comprising heating at 100-300°C for 10 minutes. (Column 5, Lines 10-13; Column 6, Lines 31-40) U.S. Patent 5,290,361 to Hayashida et al. teaches that a silicon etchant / cleaner can comprise quaternary alkyl ammonium hydroxides. (Abstract) The Examiner also notes that Applicant's Admitted Prior Art discloses that hydrogen peroxide is a known silicon etchant / cleaner. (Page 27, Lines 3-14)

10. U.S. Patent 6,884,634 to Suzuki et al. is made of record as the issue of Applicant's disclosed related case Serial No. 10/255,668. This patent, as well as the commonly assigned and/or commonly invented patents disclosed on Applicant's IDS, have been reviewed for potential double-patenting rejections. No double-patenting rejections over these patents is considered appropriate at this time, but may be reconsidered at a later time.



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11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maureen G. Arancibia whose telephone number is (571) 272-1219. The examiner can normally be reached on core hours of 10-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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